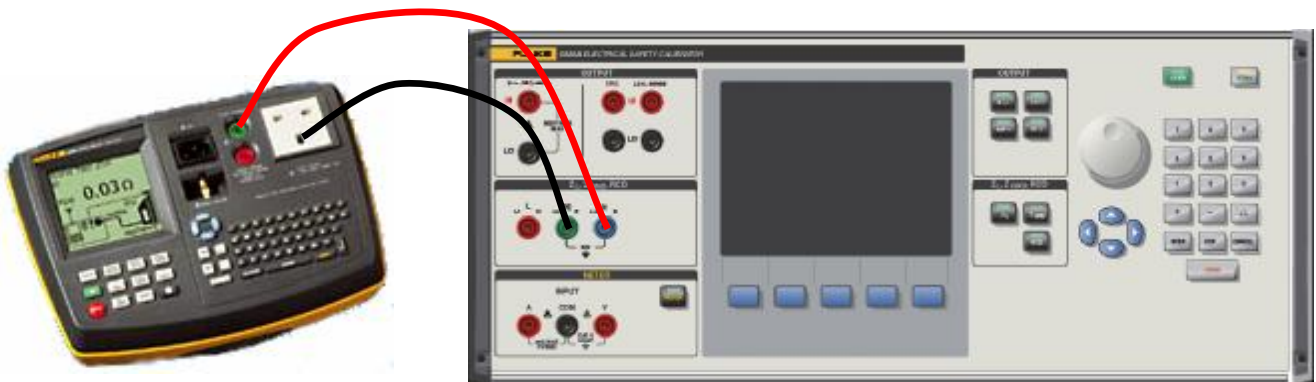


Ground bond resistance function and stability of contact resistance

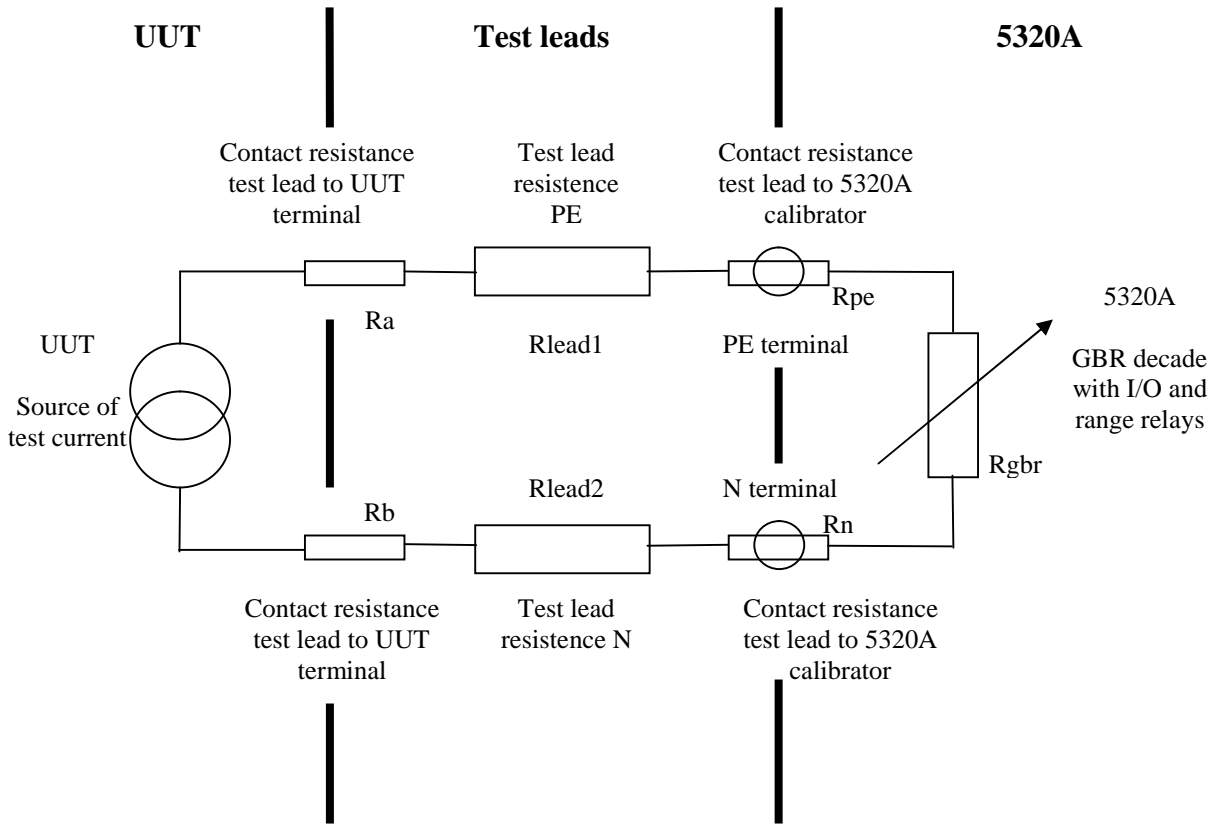
The 5320A calibrator combines a lot of functions designed especially for various types of safety testers calibration. One of these functions is = Ground Bond Resistance (GBR). In this mode, the 5320A offers 16 resistors from 25 mOhm to 1.9 kOhm with a maximum applicable test current of up to 40 A for ground bond testing.

Ground bond testers are mostly designed for two-terminal measurements, typically using high levels of current from 1 A up to 40 A. The 5320A offers direct two-terminal connections between the Unit Under Test (UUT) and the calibrator, using the PE and N terminals on the 5320A front panel. Making measurements above 1 ohm are done in a straight forward manner. However, extra care is needed to make accurate measurements below 1 ohm. This application note discusses sources of measurement error, and how to best overcome them when testing ground bond testers below 1 ohm.

A typical application connection is shown in the following picture.



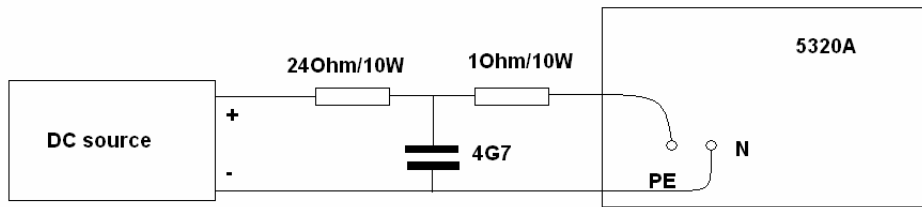
This measuring circuit can be expressed in simplified form as follows:



The resistances shown between the 5320A and the UUT are often referred to as parasitic resistances. This application note describes how to compensate for the parasitic resistors, to properly test the UUT

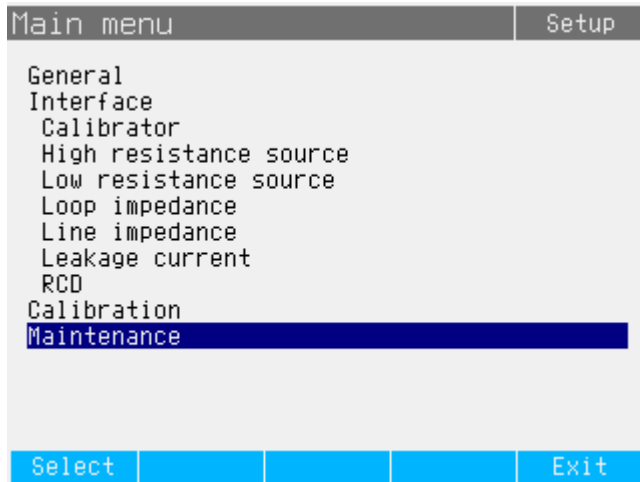
- A) **Contact resistances ($R_a + R_b$) and test lead resistances ($R_{lead1} + R_{lead2}$)** can be compensated using either the “zero” function in UUT or manually by shorting ends of the test leads.
- B) **R_n and R_{pe} contact resistances** cannot be compensated for in (A) above. Any instability of the contact resistance R_n/R_{pe} affects the calibration. Because the majority of the UUTs use a two terminal measurement method, four terminal techniques cannot be used to minimize the R_n and R_{pe} errors. The influence of dirty metal parts of the test leads and terminals can cause instability of ground bond resistance up to several tenths of mOhm. To keep R_{pe} and R_n contact resistances as low as possible, care has to be taken to ensure cleanliness of the test lead contacts and inner parts of the PE and N terminals on the 5320A front panel. The metal parts of both the test lead metallic end and the inner conductors of the P, E & N terminals should be periodically cleaned with isopropyl alcohol. The 5320A must be powered OFF before cleaning.. Test leads that no longer have springy contacts should be replaced.
- C) The **5320A ground bond output** is internally formed by 16 resistors switching through relays to the front panel terminals. The same resistors are applied in the Loop and Line resistance function. Repeated use of the 5320A ground bond decade relays can lead to degradation of their contact resistance. The 5320A uses the best power rated relays available using silver alloy contacts.. This type of relay has the highest electrical and thermal properties of all metals. However, they are affected by sulfidation. This sulfidation forms a film on the surface of the silver which increases contact resistance.

To compensate for the degradation of the relay contacts, the 5320A is equipped with a “cleaning” procedure. The procedure turns the relays on and off a number of times. An external source of DC voltage with an output voltage of approximately 20 V and a current capability of at least 3 A has to be connected to the PE and N terminals before starting the cleaning procedure. It’s best to use an external analog (linear) supply source. If a switching DC supply source is applied, two resistors and one capacitor should be inserted between supply source output and 5320A input. Analog linear power supplies do not require this external resistor and capacitor network. Changing the polarity of the DC supply source is recommended from cleaning to cleaning to avoid one-way transport of contact material from one side to the other side of the relay. Connect the power supply circuits to the 5320A only after selecting the “Relays cleaning procedure” below.

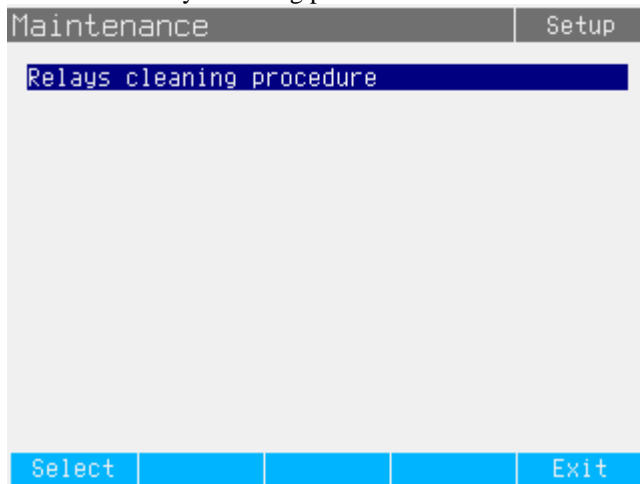


Cleaning procedure is accessible in SETUP menu. Follow the screens as shown bellow:

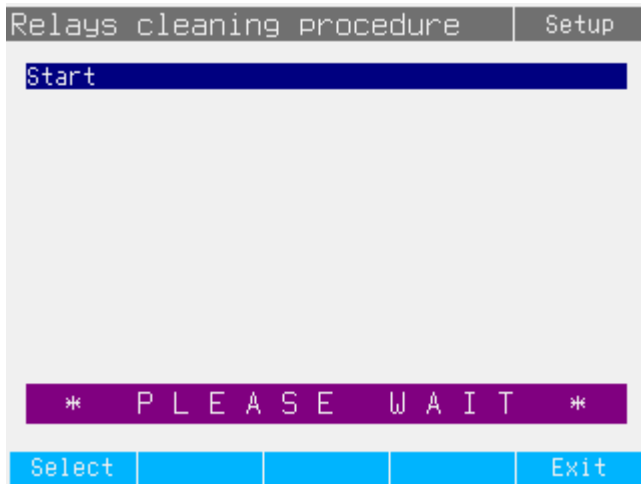
Select item Maintenance



Select item Relays cleaning procedure



Select Start. When procedure is running following information is displayed:



The procedure lasts about 15 second. During procedure 5320A cannot be operated.

Push repeatedly soft button EXIT to go back to main screen.